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**Bi-level Fuzzy Optimization Model of an Algae-Sugarcane-Based Eco-industrial Park**

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**Abstract**

Eco-industrial parks (EIPs) are designed to serve as effective measures in mitigating resource depletion and improving the environmental footprint of industrial processes. The system implements the concept of industrial symbiosis wherein an exchange of resources is conducted among the plants to achieve mutual economic and environmental benefit. The park authority has an objective of minimizing the environmental footprints of the EIP, and each respective plant aims to maximize its annual net profit while satisfying product demand. Thus, the design of the multiple resource type exchange network within the EIP can be adopted as a bi-level fuzzy optimization model, with the park authority designated as the upper-level decision-maker. The study investigates the impact of environmental footprint limits set by the park authority in the optimal design of the resource exchange networks between the plants in the EIP. A case study involving an algae-sugarcane-based eco-industrial park is considered to demonstrate the model. The results indicate that a compromise can be achieved between the levels of decision-makers at an overall degree of satisfaction of 0.189. This suggests the feasibility of the proposed EIP model accounting for the objectives of both levels of decision-makers.